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(71) Applicant

Albany International Corp

(Incorporated in the USA - New York)

1373 Broadway, Menands, New York 12204,
United States of America

(72) Inventor

William H Dutt

(74) Agent and/or Address for Service

Gill Jennings & Every

53-64 Chancery Lane, London, WC2A 1HN,
United Kingdom

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None

(58) Field of search

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(54) Extended nip (shoe) press belt and its manufacture

(57) A method for manufacturing a belt of a type suitable for use in extended nip (shoe) presses of a papermaking machine, which comprises the steps of:

(a) closing, between the upper and lower platens (1, 2), of a platen press, an insert plate (3), a polymer sheet (7), and part of an elongate fabric base, e.g. an endless fabric (4) held taut between rolls (5);

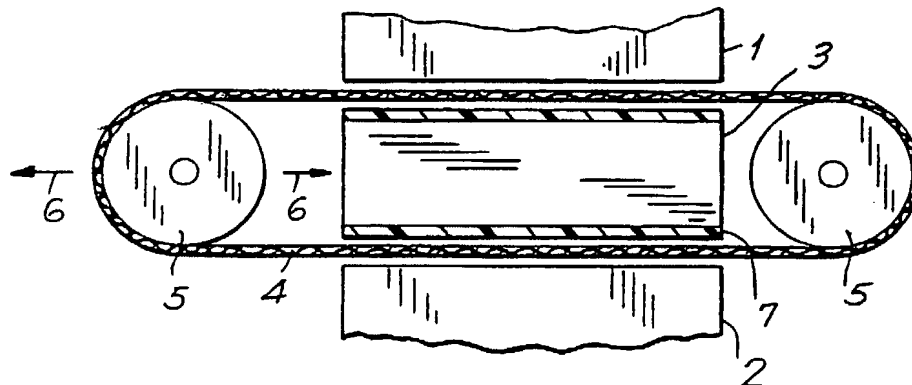
(b) opening the platen press after a time sufficient to melt the polymer and force it, in liquid form, into the structure of the fabric base;

(c) advancing the fabric base in the platen press to the point where fabric, as yet untreated with polymer, is adjacent to the insert plate;

(d) inserting polymer sheet into the platen press, closely butting it to the melted polymer; and

(e) repeating steps (a) to (d) until the entire length of the fabric base has been coated and impregnated with polymer.

FIG. 1



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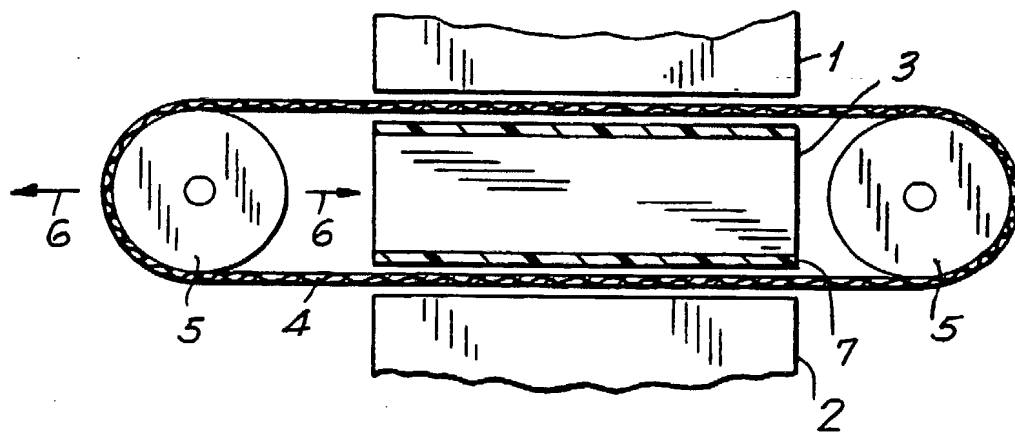
FIG. 1

FIG. 2a



FIG. 2b

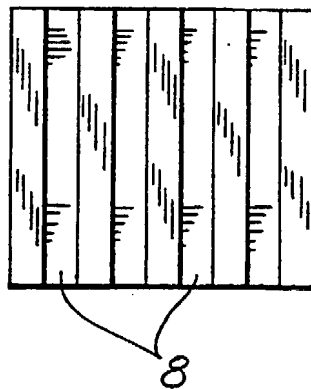


FIG. 2c

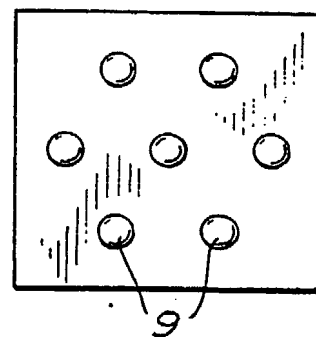


FIG. 3a



FIG. 3b



FIG. 3c



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EXTENDED NIP (SHOE) PRESS BELT
AND ITS MANUFACTURE

Field of the Invention

This invention relates to a method of more efficient water removal from a wet sheet of fibrous material in the press section of a papermaking machine. More specifically,
5 it relates to the production of a special belt for use in an extended nip (shoe) press and of a method for the manufacture of such a belt.

Description of the Prior Art

The efficient removal of water from the wet sheet of
10 fibrous material in the press section of a modern papermaking machine is an important factor in toward the economical production of paper. Various approaches toward improved water removal have been taken in the past and have involved different press designs and improvements in the press
15 clothing or felt used to absorb water from the wet sheet. The goal of such approaches has always been to remove as much water as possible from the sheet before it reaches the dryer section of the papermaking machine. In that section, heat is applied to the sheet to drive off the remaining water. The
20 more water removed in the press section, therefore, the less will remain to be heated out or evaporated in the dryer section. Costs associated with such heating will then be reduced, and the plant will be operated and paper produced more economically.

25 The press section of a papermaking machine has historically consisted of a series of double rolls through

which passes the wet fibrous sheet either supported on top of an absorbent felt or sandwiched between two such felts. The region between the two rolls, referred to as the nip, is where the felt and wet fibrous sheet are compressed together, and where water, squeezed from the sheet, is absorbed by the felt.

Because the nip is of limited spatial extent, the dwell time, or time spent there by a given incremental length of felt and wet fibrous sheet, is brief. As a consequence, the press section of many papermaking machines commonly consists of a series of press rolls, so that sufficient water can be removed from the sheet before it reaches the dryer section.

Further, as a way to improve water removal, the surfaces of the press rolls can be drilled with holes or grooved, in order to provide ways for water to pass from the felt. This will reduce rewetting of the sheet upon exit from the nip. As another refinement, suction can be applied from within a drilled press roll in order to draw additional quantities of water from the felt and away from the sheet. Such a device is referred to as a suction press.

Other approaches toward the removal of increased quantities of water in the press section involve attempts to lengthen the dwell time in the press nip. This can be accomplished by covering the press roll with an elastic, compressible material, so that the nip will be slightly broadened when the press rolls are brought together. Dwell time will be extended because it will take a given incremental length of wet sheet longer to cover this slightly greater distance.

The greatest increase in dwell time, however, can be realized through the use of the extended nip (shoe) press. Here, one of the two rolls in a conventional press is

replaced with a pressure shoe. The shoe is typically as wide as the press roll in the cross-machine direction. The side of the shoe facing the press roll is cylindrically concave, and of approximately the same radius as the roll. When the shoe is brought up to a position close to the roll, a narrow gap is created between the surface of the spinning roll and the concave, stationary surface of the shoe. With a shoe of appropriate size, the length of this gap will be much greater than that of the nip in a conventional two-roll press. Therefore, by passing the felts and wet fibrous sheet through such a gap, a greater dwell time is obtained and more water is removed from the sheet.

A potential problem arises, however, with the use of such a press. As the surface of the shoe is not itself in motion, friction between the felt and that surface will cause the felt to wear. To alleviate this problem, and to make it less likely that the felt will be damaged by friction, a special belt is run between the surface of the shoe and the felt. Lubricated on the side in contact with the shoe, such a belt provides a surface moving in the same direction as the felt. Less frictional wear on the felt will occur because it moves with the belt through the nip and does not itself slide over the shoe.

SUMMARY OF THE INVENTION

This invention consists of a special belt for use in an extended nip (shoe) press and a method by which it can be manufactured. The object of the invention is to provide a means of producing these special belts in an economical way which requires fewer manufacturing steps than previously were necessary, and which allows the use, as impregnates into a fabric base, of polymeric materials that could not

previously be used. The fabric base is so impregnated in order to prevent the lubricating fluid on the side of the belt actually in contact with the surface of the shoe from passing through and contaminating the wet sheet and felt.

5 The invention envisions the use of a large heated platen press composed of two opposed platens and a special insert plate. The base fabric for the belt is provided in endless form, and is placed around the insert plate in a sleeve-like fashion. The insert plate itself should be at least as wide
10 as the base fabric, and should have approximately the same length and width as those of the upper and lower platens.

Sheets of uncured thermoset or thermoplastic polymer are then placed in the spaces between the inside of the base fabric sleeve and the insert plate. Pressure and heat are
15 then applied, by closing the platen press which will cause the base fabric to become impregnated with the polymer. If required, the polymer can also be cured in this manner.

After a suitable time, the platen press is opened, and the base fabric sleeve is rotated around the insert plate
20 until areas not yet impregnated with polymer are above and below the insert plate. Sheets of uncured polymer are inserted as before, and the above process is repeated until the entire inner surface of the base fabric sleeve has been so treated.

25 Modifications to this procedure may be suggested by the nature of one's immediate application. For example, if a higher degree of quality control is desired, only one side of the insert plate need be used at any given time. In such a case, heat and pressure will be applied with only one of the
30 two platens, and the other will be unheated. Alternatively, one could apply the polymer sheet to both sides of the base fabric rather than to the inside alone.

Both the belt and its method of production have numerous advantages to commend themselves to future users. Through the use of a platen press and insert plate to produce the special belts, one obtains a final product which did not
5 have to be turned inside out during manufacture. In addition, the current need to apply the polymer to the surface of the base fabric as a coating, which would later require curing and grinding, is eliminated. As a result, equipment costs can be saved, processing time shortened, and
10 a belt superior to those currently available produced. The thickness uniformity of the resulting belt can easily be controlled by maintaining a constant spacing between the insert plate and the upper and lower platens. Finally, through the use of an insert plate and/or platens whose
15 surfaces are not smooth a belt, whose surfaces have ridges, grooves, or other surface characteristics, rather than being smooth, can be produced.

BRIEF DESCRIPTION OF THE DRAWING

In Figure 1 is depicted a scheme by which the special
20 belt for the extended nip (shoe) press can be manufactured according to this invention. Shown there is one mode in which this invention can be practiced, whereby polymer sheet is placed only between the base fabric and the insert plate.

Figures 2a, 2b, and 2c are plan views of the surface of
25 an insert plate or platen which is smooth, grooved, or which has round protrusions, respectively, in order to impart corresponding surface characteristics, as desired, to the extended nip press belt.

Figures 3a, 3b, and 3c are section views of the insert
30 plate or platen shown in Figures 2a, 2b, and 2c, respectively.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in Figure 1, the method envisioned for producing the special belts of this invention requires the use of a heated platen press having upper 1 and lower 2 platens. A special insert plate 3 fits into the space between the upper 1 and lower 2 platens. In this preferred embodiment of the invention, the surfaces of these platens have identical linear dimensions and areas. The upper and lower surfaces of the insert plate 3 facing the platens have these same size parameters. In addition, the platens 1, 2 and insert plate 3 should have at least the same width as that of the belts they will be used to produce.

The base fabric 4 for the belt, supplied in endless form, is arranged around the insert plate 3 in a sleeve-like fashion in the spaces between said plate and the upper 1 and lower 2 platens. This base fabric 4 can be either single - or multi-layered and woven from polyester monofilament in a weave pattern that is sufficiently open to permit it to be completely impregnated and coated. This will eliminate the production of voids which would allow the lubricating fluid used between the belt and the shoe to pass through the belt and contaminate the felt and fibrous web. The base fabric 4, finally, can be supplied in any length as the method of this invention does not require the use of a mandrel.

Rolls 5, driven by an appropriate means, are used to keep the base fabric 4 taut, by being adjustable as indicated by the arrows 6, and to advance it section-by-section as it is being treated in the manner taught by this disclosure. Sheets of an uncured polymer 7, such as polyurethane, are placed between both sides of the insert plate 3 and the portions of the base fabric 4 above and below the insert

plate 3. The platen press is then closed by bringing the upper 1 and lower 2 platens toward each other, compressing the base fabric 4, polymer sheets 7, and insert plate 3 together. Pressure and heat from the platen press melt the polymer sheets 7 and force this liquified material into and around the woven structure of the base fabric 4. This procedure can also cure the polymer.

At the end of the time interval required for the above, the platen press is opened, by moving the upper 1 and lower 2 platens apart. The base fabric 4 is then advanced, by using the rolls 5, to the point where areas of the base fabric 4 into which no polymer sheet 7 has yet been forced are located above and below the insert plate 3. New polymer sheets 7 are then inserted between both sides of the insert plate 3 and the portions of the base fabric 4 above and below it. This time, however, the sheets are properly and tightly butted against the just previously pressed-in sheet, and the pressing-in process described above is repeated.

The steps of this procedure are repeated until the inside of the base fabric 4 has been completely treated in this manner, thus producing the special belt of this invention.

As noted above, it may often be of interest to produce an extended nip press belt whose surfaces are not absolutely smooth but rather have grooves, indentations, or other surface characteristics. This can be accomplished by using insert plates and/or platens having surface characteristics which will impart corresponding ones to the belt during production. Figure 2a shows a plan view of a smooth insert plate or platen, and Figure 3a is a section view of the same, for use in making a smooth belt. A grooved belt can be manufactured by using a grooved insert plate and/or platen

having grooves 8, shown in the plan view of Figure 2b and in the section view of Figure 3b. Lastly, a belt having indentations can be produced by using an insert plate and/or platen having protrusions 9, as shown in Figures 2c and 3c.

- 5 An infinite number of other possible surface patterns can be obtained through the use of appropriate insert plates and/or platens during the manufacture of the belt.

CLAIMS

1. A method for manufacturing a belt of a type suitable for use in extended nip (shoe) presses of a papermaking machine, which comprises the steps of:

- 5 (a) closing, between the upper and lower platens of a platen press, an insert plate, a polymer sheet, and part of an elongate fabric base;
- (b) opening the platen press after a time sufficient to melt the polymer and force it, in liquid
10 form, into the structure of the fabric base;
- (c) advancing the fabric base in the platen press to the point where fabric, as yet untreated with polymer, is adjacent to the insert plate;
- (d) inserting polymer sheet into the platen press,
15 closely butting it to the melted polymer; and
- (e) repeating steps (a) to (d) until the entire length of the fabric base has been coated and impregnated with polymer.
2. A method according to claim 1, wherein the fabric
20 base is in endless form and is draped in sleeve-like fashion around the insert plate.
3. A method according to claim 2, wherein the fabric base is maintained on a taut condition around the insert plate by first and second rolls on opposite sides of the
25 platen press.
4. A method according to claim 3, wherein the first and second rolls advance the fabric base during the manufacture of the belt.
5. A method according to any of claims 2 to 4, wherein
30 the polymer sheet is inserted between the upper and lower surfaces of the insert plate and the fabric base.
6. A method according to any of claims 2 to 4, wherein the polymer sheet is inserted on both sides of the fabric base.

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7. A method according to any preceding claim, wherein the base fabric is woven from polyester monofilament in an open-weave pattern.
8. A method according to claim 7, wherein the base fabric is a single-layered weave.
9. A method according to claim 7, wherein the base fabric is a multi-layered weave.
10. A method according to any preceding claim, wherein the polymer is polyurethane.
11. A method according to any preceding claim, wherein the insert plate has a smooth surface.
12. A method according to any of claims 1 to 10, wherein the insert plate has a surface bearing a pattern to be impressed on the surface of the belt.
13. A method according to any preceding claim, wherein the upper and lower platens have smooth surfaces.
14. A method according to any of claims 1 to 12, wherein the upper and lower platens have surfaces bearing patterns to be impressed on the surface of the belt.
15. A method according to claim 1, substantially as herein described with reference to any of the accompanying drawings.

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